REPORT

—on—

Property

—of—

Drum Lummon Mines Ltd.

—By—

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Drum Lummon Mines, Ltd.

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REPORT

(QUOTED IN PART)

ON DRUM LUMMON MINES.

BY EDWIN T. HODGE, M.A., PH.D

INTRODUCTION

This report is of an examination made during the first week in August, 1919.

CONCLUSIONS

The ore bodies belong to a class intermediate between pegmatites and deep seated veins.

There is a good chance that this ore deposit, when developed. may prove to contain replacements, stockworks and lenses close enough together to pay to mine.

There is also a probability that lenses of bornite-chalcocite rich in silver and associated with native gold of bonanza proportions may be found.

Bornite, chalcocite and native gold are primary in origin.

The property is well located as to harbor, townsite, millsite and water power.

Further development work is essential.

The present drift should be continued along the quartz-pegmatite system as far as possible or to a maximum of 2,000 feet.

A set of rolls should be placed in the mill. The location of the latter will serve for the present but if, after six months' development work, the property should continue to look as promising as it does now, then the mill should be relocated and re-organized.

LOCATION

The property described below is located just north of and adjacent to Drum Lummon Bay, Douglas Channel, British Columbia. It lies about 25 miles north of Hartley Bay Post Office, about 90 miles south of Prince Rupert, and about 450 miles northeast of Vancouver. Hartley Bay is a weekly port of call for one of the mail steamers of the Union Steamship Co., Ltd.

LOCAL GEOLOGRAPHY

The underground workings are located in a narrow draw about one mile from and 400 feet above tidewater. The camp is on the beach and is reached by a cleared but not graded road. This road follows a small stream, which it crosses several times. The first four thousand feet of the road rises about one foot in ten, and the last thousand feet adjacent to the mine rises about three feet in ten. The location of the mine portal and mill in a narrow draw is a serious impediment to easy development and a situation which will have to be remedied in the near future if development work so warrants.

The present camp is located at the mouth of a small creek which at high tide is navigable to shallow draft vessels. Ocean going vessels can anchor at a float about 2,500 feet from the creek mouth. Just south of the creek is a peninsula which will make an excellent townsite. A wharf 300 feet in length on the south side of this peninsula would give safe anchorage to deep sea vessels.

From the north shore of Drum Lummon Bay, the ground rises about 300 feet in a distance of some 4,500 feet, then rapidly rises along the slope of a mountain which rises to a total height of 4,500 feet. About one mile across country to the east is a stream large enough to furnish ample power. There is an abundant supply of excellent timber on the property.

COUNTRY ROCK

The country rock is a coarse grained hornblende granite. A streaked structure or a primary gneissic and schistose structure is found at an elevation of about 1,800 feet, due to mountain making movements at the time of consolidation of the country rock.

Assays of the country rock close to ore bodies all gave traces of gold, silver and copper.

At about 2,000 feet elevation there is a very large basic segregation in the granite, made up of biotite, augite and hornblende. Aside from the above variations the country rock is a uniform fresh hornblende granite.

DIKE ROCKS

The above rock is cut by many dikes. Most of these dikes appear to have a northwest-southeast strike. Fewer have a northeast-southwest strike. All follow more or less the direction of the jointing planes in the country rock—a fact which suggests their genesis at the time when the outer part of the hornblende batholith was consolidated but still cooling, and while the inner portion of the batholith was still liquid.

Two principal types of dike rock occur—aplite pegmatites and augite comptonites.

The former are dikes irregular in shape and disconnected in length. The aplitic or fine grained phase is much the more common. They swell to 10 feet in thickness and may, in a lineal distance of 20 feet, pinch to less than a foot in thickness. The dikes often send off apophyses or stringers into the country rock. Many of these dikes contain large irregular inclusions or horses of the country rock. The general strike is regular, but there are many local flexures of strike and changes of dip.

Quartz is the principal constituent of the coarse pegmatites. It occupies the centre of the dikes as a rule and frequently makes up the entire dike; in places it breaks through the dike wall and penetrates the country rock. Orthoclase occurs as regular crystals along the dike walls and frequently forms a solid mass, separating the quartz from the country rock. Muscovite occurs irregularly in small bunches, usually close to or in contact with the orthoclase.

In the aplitic phase quartz is subordinate and the minerals are distributed regularly through the dike.

Copper minerals are found in these aplite-pegmatite dikes, either as isolated bunches in the quartz or as interstitial masses between the feldspars.

A common feature is the presence of small bunches of magnetite along the contact of the aplite-pegmatite and the country rock.

The augite comptonite dikes are far more regular, both in dip and strike, than the aplite-pegmatites. They are composed chiefly of augite, with some hornblende. Since their injection into the granite they have been highly sheared and slickensided. They vary from very fine grained basalt like rocks to coarse porphyries. They are also associated with copper minerals.

Dikes of the above types occur in many places over Drum Lummon Mountain. Perhaps in the future it would be worth while prospecting some of the more attractive of these dikes, but at present I would recommend that exploration work be confined to the dikes described below.

The dikes now under exploration lie about 400 feet above sea level and are exposed by a small stream which cuts across them almost at right angles. These dikes are four in number. The southern-most is a pink aplite which strikes N. 81° W. and which I will call dike No. 1. About 20 feet north, and almost parallel to the above aplite dike is a coarse pegmatite dike called dike No. 2. Its walls show a parallel banding in which fine grained granite alternates with bands of quartz. Next to, or making the wall, is a band six inches to one foot thick, of very fine grained micaceous granite.

Within the parallel bands of quartz and fine grained granite is a fine band six inches to a foot thick, made up of orthoclase crystals one-half inch to several inches in diameter. Every few inches along the outer contact of the orthoclase are small areas of magnetite. Sometimes the orthoclase, associated with more or less muscovite, fills the whole dike. Usually, however, the centre of the dike is occupied by white milky quartz. Near walls, but within this quartz, are a few very large crystals of orthoclase several feet in diameter. The quartz often cuts through the walls of the dike and penetrates the country rock as apophyses. The above description indicates that this dike is not a true pegmatite, but partakes in part of the characters of deep-seated quartz veins.

Sixty feet north of the above dike is another which strikes N. 72° W. This particular dike varies in detail, but essentially has the same features as dike No. 2. One of the quartz apophyses running from dike No. 2 reaches and coalesces with this dike No. 3.

One hundred feet north of dike No. 3 is an aplite dike, two or three feet thick, and which contains a very large horse (10 feet x 3 feet) of country rock—called dike No. 4.

From the above description it will be seen that there is decided symmetry to these dikes. Two similar quartz-pegmatite dikes lie between two aplite dikes. All four dikes have a similar N. 65-85° W. strike, and all dip south at very steep angles. The two quartz-pegmatite dikes are linked together by apophyses of quartz.

On the surface these dikes show exceptional persistency. A small draw has been cut by natural agencies along the crop of each dike—due to their lack of resistence to weathering. The dikes themselves can only be traced continuously for 400 feet, but these draws can be traced considerably further. I would recommend that the surface extension of these coarse quartz-pegmatite dikes be traced by surface pits as far as possible.

The above four dikes are definitely related to the mineralization. Two of them are definitely related to each other and it is possible that the masses of rock between them as seen on the surface and in the present workings are only great horses—that these quartz-pegmatite are parts of the same dike. The two aplites to either side also suggest a common relationship. Aplite is a common form for apophyses of pegmatite to take and pegmatites are characterized by many apophyses. It is, therefore, reasonable to suppose that these aplites are definitely related to the two quartz-pegmatites.

If all four dikes are really only part of one pegmatite injection then they may be expected to have considerable extension in length and depth.

Pegmatites and their fine grained phases—aplites—are the consolidated residual juices of a batholith. A batholith is an enormous mass of injected liquid rock commonly forming the core of a mountain range. A batholith cools and consolidates from the periphery inwards. The consolidation forces towards the centre those batholithic juices which are not easily solidified. After a long time so much of this juice will be forced to the centre that it exists there under enormous pressure. These juices under this great pressure will, if the pressure is relieved by fracture of the batholith shell, force their way out into such fractures and there consolidate. Pegmatites are, therefore, formed very deep in the earth's crust and exposed only by the removal by erosion of great quantities of overlying rock.

The above description of the origin of pegmatite should be modified by considering the residual juices to be exceptionally rich in quartz and producing instead of a pure pegmatite—one possessing in part the characteristics of a deep seated quartz vein.

MINERALS ASSOCIATED WITH THE DIKES

The above quartz-aplite-pegmatite dikes have definite mineral associations of greater or less genetic and economic significance.

Among the non-metallic minerals are quartz, orthoclase, margarite, clintonite, plagioclase and calcite.

Quartz is the most important mineral constituent. It occurs principally as a milky white, highly fractured and sheared vein filling. Some of it is transparent. Large areas in the vein are composed of little quartz crystals 1/3 inch long, having perfect crystal form and lining, and almost filling small cavities or vugs. For the most part the quartz fills the centre of the veins. However, it frequently cuts through the vein walls and extends in large irregular masses 20 to 30 feet away from the vein. The quartz is intimately associated with every other mineral in the deposit and is genetically related to the economic minerals. Adjacent to the quartz will be found all the ore bodies.

The quartz gangue is in itself economically important because in all smelters operating on the north Pacific coast ores rich in quartz should at the present time be smelted at minimum cost.

Pink orthoclase is also an important mineral. Occasional specimens occur within the quartz, but usually it holds a peripheral relationship to the quartz. Commonly it occurs in perfect rectangular crystals bordering the walls of the pegmatite dikes. Some of the crystals are several feet in diameter. The quartz and orthoclase hold such a relationship (eutectic) that they are shown in part to have developed at about the same time. The quartz developed a little later, as shown by the fact that the quartz cuts through the orthoclase crystals by means of many veinlets.

Orthoclase is intimately associated with the economic minerals. Aplite dike No. 1, which is largely composed of orthoclase, assayed: Gold, trace; Silver, 0.35 oz.; Copper, 0.09%. Veins of the ore minerals penetrate and replace the orthoclase. Orthoclase is a potassium silicate and valuable as a flux. Ore rich in this gangue should command the very best smelter rates. The largest bunches of ore will be found associated with orthoclase, and especially near the orthoclase quartz contacts.

Chloritoid is a very abundant green mica. It occurs in country rock adjacent to pegmatite and abundantly in the pegmatite. The heated solutions accompanying the pegmatite penetrated the country rock for several feet. These solutions transformed the hornblende of the country rock into chloritoid. The chloritoid crystals occur between the orthoclase, plagioclase and quartz crystals of the granite. Some of these interstitial chloritoid masses are replaced by copper minerals. Thus a sample without evident mineralization gave: Gold, trace; Silver, 0.35 oz.; Copper, 0.09%. Masses of country rock so altered will be found along the vein walls. Much of it will pay to mine and will as a low grade ore.

The chloritoid also occurs associated with orthoclase and quartz. It frequently forms a thin veneer around quartz or orthoclase crystals. It occurs in leaves six inches broad between quartz and orthoclase.

It is almost always associated with copper, gold and silver minerals. Masses of copper mineral frequently occur between leaves of chloritoid. Tiny veinlets of copper minerals cut the chloritoid. Orthoclase and plagioclase are frequently stained green by fine crystals of chloritoid.

Among the metallic minerals are the following: gold, chalcocite, bornite, chalcopyrite and magnetite.

GOLD

This property is usually looked upon as a copper mine, but I am of the opinion that gold values may be the determining factor in making it a productive mine. Every sample that I have taken shows a trace of gold. The gold occurs as irregular shaped nuggets, as sheets, and as tiny flakes. It is always in quartz, but in close association with chalcocite and bornite. Thus, whereas it always occurs in quartz, it is never far from some sulphide mineral.

Gold values are constant in all the ore. Small gold shoots have been found and I anticipate the finding of larger gold shoots, some, perhaps, of bonanza type. The finding of a few large shoots of rich gold ore are one of the possibilities in this property—a possibility which makes it worthy of further development.

BORNITE, Cu_5FeS_4.

This is a brittle mineral of deep peacock color, carrying, when pure, 63.3 per cent copper. Bornite replaces chloritoid in the country rock. It occurs associated with chalcocite as veinlets and veins cutting orthoclase, plagioclase, and quartz. It occurs interstitially between orthoclase and quartz and chloritoid. Whereas it occurs as veins cutting these gangue minerals, its relationship with them is so intimate that I think it developed at the same time and is of the same origin. The veins not only fill fractures, but also replace the walls of the veins. Such replacements may form large masses of bornite. Some masses two to three feet in diameter have been found and it is probable that lenses of bonanza size may be found.

CHALCOCITE, Cu_2S.

This is a light to dark grey mineral which, when pure, contains 79.8 per cent copper. It occurs in intimate association with bornite and all that has been said of bornite is true of chalcocite. The bornite cuts the chalcocite but is more often inter-grown with it. The chalcocite at times carries high silver values.

Large shoots of bornite-chalcocite are one of the possibilities in this deposit and, like the gold prospects, make this deposit well worth extensive exploration and development.

CHALCOPYRITE, $CuFeS_2$

This is a yellow mineral of copper which carries about 34.5 per cent copper. It is not very common. It cuts as veinlets both the chalcocite and bornite and hence was a little later in development. It has a peripheral relationship to bornite and chalcocite.

MAGNETITE

Small areas occur along walls of dike.

HEMATITE

Specular hematite occurs along shears in veins.

OTHER MINERALS

Pegmatite veins are frequently the course of rare and gem minerals. The above list does not include the minerals that are sure to be found—some of which may be of economic importance.

PRIMARY AND SECONDARY MINERALS

Secondary minerals are those formed by the action of air and surface water. Such minerals never extend to any considerable depth. Bornite and chalcocite are frequently secondary. In this deposit I am absolutely certain that bornite, chalcocite and gold are primary and will be found in greater or less amounts wherever the pegmatite vein is found, either laterally or in depth. A few secondary minerals which do occur are malachite, azurite and native copper. These minerals will not be found after the deposit is followed to greater depth, and they do not now occur in significant amounts.

SHAPE OF ORE BODIES

Three types of ore bodies will be found: replacements, veins and lenses. As stated above, bornite replaces the chloritoid in the country rock. This replacement is most intense next to the quartz and fades out at a distance from the quartz. Areas so replaced will not occur everywhere along the quartz vein walls, but here and there in bunches. Replacements can easily be found due to the change of the country rock to a rock rich in green brittle mica.

Much of the ore will occur in veins. Few of these veins will be large—most will be very small. Their value from a mining point of view will not be their size, but the number and the distance they are apart. In other words no single vein will be mined alone, but a large number mined together, including a certain amount of country rock.

A sample across eight inches of such a mass in No. A stope assayed: Gold, 0.08 oz.; Silver, 0.81 oz.; Copper, 2.79%.

The third type will be the lenses—solid masses of ore of lenticular shape.

All of these ore bodies will be associated with quartz. Most of them will occur at the contact of the quartz with the country rock and will be especially well developed where orthoclase and chloritoid occur in abundance.

The most noticeable feature of all ore bodies will be an irregularity. Beneath and controlling this irregularity will be found a certain system. The irregularity will express itself in the size, shape and distance apart of the replacements, veins and lenses. Certain parts of the quartz-pegmatite will be almost devoid of economic minerals, except perhaps a thin stringer—which may change suddenly to a large lens, or a thickening of the vein, or a large replacement. After a certain amount of development work has been done, there will appear a system to these changes. The lenses will be found to average a certain size—to be spaced within a definite distance of each other, and to occur in some particular part of the pegmatite.

As stated above there are four closely related dikes. These dikes are apt to coalesce or to further subdivide.

Beginning at the surface a large mass of quartz forming a part of dike No. 2 plunges down and toward the northwest. In the mine workings this mass of quartz is found to be a part of dike No. 3. Such masses of quartz are to be expected connecting at least these two dikes, and probably also dikes No. 1 and No. 4. Masses or shoots of quartz of this character connecting the two or more dikes will occur every so often. These shoots will carry about their peripheries ore bodies as above described. If these shoots should be found to be frequent, ore bodies adjacent to them may be very large. The quartz will not only occur as shoots, but will also follow the dikes, associated with more or less ore.

ORIGIN OF ORE BODIES

The ore bodies are simply such portions of the quartz-pegmatite which happen to be composed of minerals of economic worth. The minerals of the quartz-pegmatite have a contemporaneous origin in general, but in detail their order of consolidation appears to have been about as follows: Orthoclase, Quartz, Plagioclase, Chloritoid, Bornite, Chalcocite, Chalcopyrite, Gold.

These minerals consolidated in fractures and in part dissolved away the walls of these fractures and filled the dissolved areas with new minerals.

During the consolidation mountain movements of small magnitude occurred so that the orthoclase, quartz and plagioclase were fractured. Minerals solidifying later occupied the fractures so formed in the older minerals.

PROBABLE SIZE AND EXTENSION OF ORE BODIES

I look upon the above deposit as one intermediate between a pegmatite dike and a deep seated quartz vein. Such deposits are extremely rare. Because of their rarity it is very difficult to speak from previous experience in mining of such deposits what may be expected. The ore bodies will be irregular in shape, variable in size and separated from each other by indefinite spaces. There are three possibilities:

1. The ore bodies may either be so small or so far apart that they may not pay to mine.

2. The ore bodies may all be small, but close enough together to pay to mine in a small way.

3. Most of the ore bodies may be as in [illegible]s 2, but here and there a large one may be found of bonanza proportions and affording spectacular returns.

The amount of development work done to date makes me think the possibilities lie in group 2 or 3. Only carefully conducted development work will prove to which group the deposit really belongs.

RECOMMENDATIONS

I would recommend that the present dike system be followed into the mountain as far as possible, or to a maximum distance of 2,000 feet.

METHODS OF MINING

Ore bodies having the above described peculiarities must be developed and mined with exceedingly great care. The development work of each preceding week *only when properly interpreted* will determine the next week's campaign. The determination of the lineal continuation of the dikes and their relationship to each other should be the essential purpose of at least the next six months' campaign. The extraction of ore sufficient to pay costs or dividends should be made a subordinate consideration.

A good property may be ruined unless a policy of careful development work is pursued. Many good properties have been ruined by an attempt to pay dividends too soon. With the idea of development work in mind care should be taken:

1. To make assays frequently of country rock, dike rock and all variations in vein filling.

2. To keep a careful record of all rock and mineral passed through or mined.

3. To keep up a continuous geological study of the possibilities.

All available men and equipment should be kept on exploration work. Only should men and equipment be used to stope out ore when they can not be engaged in exploration work.

It is to be hoped, and I think it is reasonable to expect, that in the exploration work considerable ore will be found which will pay in greater or less degree the cost of exploration work.

In mining such ore, if high grade, the following points should be kept in mind:

1. Pick directly out of the face and sack all high grade bunches or lenses.

2. Shoot the remainder down on canvas.

3. Pick out of the canvas all waste rock.

4. Sort out of canvas and sack all high grade specimens.

5. Send remainder by means of cars to mill.

6. The fines remaining on the canvas which will usually be high grade should be sacked separately.

7. Before milling the ore should again be hand cobbed and the high grade material sorted out.

The result of the above will be to save high grade ore—especially gold—which is very apt to be lost. It will produce rich shipping ore at only the cost of mining. It will take some of the burden off the mill. Such care need not be exercised with the low grade ore.

The ore will occur peripherally around quartz masses—much in the same way as a shell occurs around an egg. Care should be taken not to mine any more of the barren central quartz mass than is necessary.

The drifts should be kept as small as possible consistent with expedient development—4 x 7 feet is recommended.

DRIFT—SHAFT—DEEP TUNNEL

Every foot of the present drift gives about 14 inches of back, and if driven 2,000 feet, about 2,500 feet of back will be given. Should 2,000 feet of minable ore be found sufficient stoping-head will exist to occupy a great many years of mining. Furthermore, an explanatory drift offers possibilities of paying for itself or even of putting property on paying basis.

A deep tunnel would have to go through about 1,000 feet of barren rock and would only give 300 feet more of back than the drift. Furthermore, it runs the risk of not meeting the vein at depth.

Since the ore bodies are irregular a shaft starting in good ore might pass down through several hundred feet of poor ore, which would be discouraging—cost about $100.00 per foot—and prove but little.

I would, therefore, recommend driving the present drift into hill along the strike of the dike system, as long as conditions still appear as favourable as they do now.

MILL

Rolls should be installed capable of crushing a one inch feed to a minus ¼ tail, and producing about 50 cubic feet of finished product per hour. Such a roll should be a simple belt-driven, rigid roll.

If such a roll is introduced it will require a re-arrangement of the screens, beginning with 4 mesh, then 16, 32 and 40 mesh. It will also require re-adjusting the jig now working on plus ¼ inch to work on 1/4—1/16 mesh material.

Even if the above changes are adopted the present mill will not be able to handle all the tailings from the jigs and there is bound to be a loss of about 1/3 to 1/4 of jig tailings. This is inevitable but not serious.

NEW MILL

When the mine is more thoroughly developed then it may be wise to design a new mill and a new milling system. If such should be the case a tram line from mine portal can be run around hill southeast for 500 feet. This would reach an excellent mill site affording good site for incline train, room for storage bins, room for mill, with each unit arranged to be fed by gravity and large space for dumping waste.

This location could be reached from townsite and harbor by a one mile road of easy tramway, or motor truck grade.

WATER POWER

Such a site would give a 300 foot head for the small stream flowing past mine. I am inclined to think that by means of a simple dam sufficient water may be obtained to supply mill with water and power the year round, and so effect a very heavy saving in fuel or gas engine service.

(Signed) August 22, 1919,
"EDWIN T. HODGE,"
Consulting Geological and Mining Engineer.

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